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A special feature of the series is that it highlights each scientist's childhood. Young readers will see quite vividly that the great scientists had once been children like themselves and that if their natural curiosity as children can be combined with perseverance, they may also be able to achieve what these people did.

Little Alexander loved sound. Yet, what made him enter the silent world of the deaf? He gave our world a tinkle. Does it ring a bell?

Mary Joseph taught English Literature at the Universities of Delhi and Bombay and has written a number of books for her favourite readers – children. She now is Chief Editor at Learners Press Pvt. Ltd.

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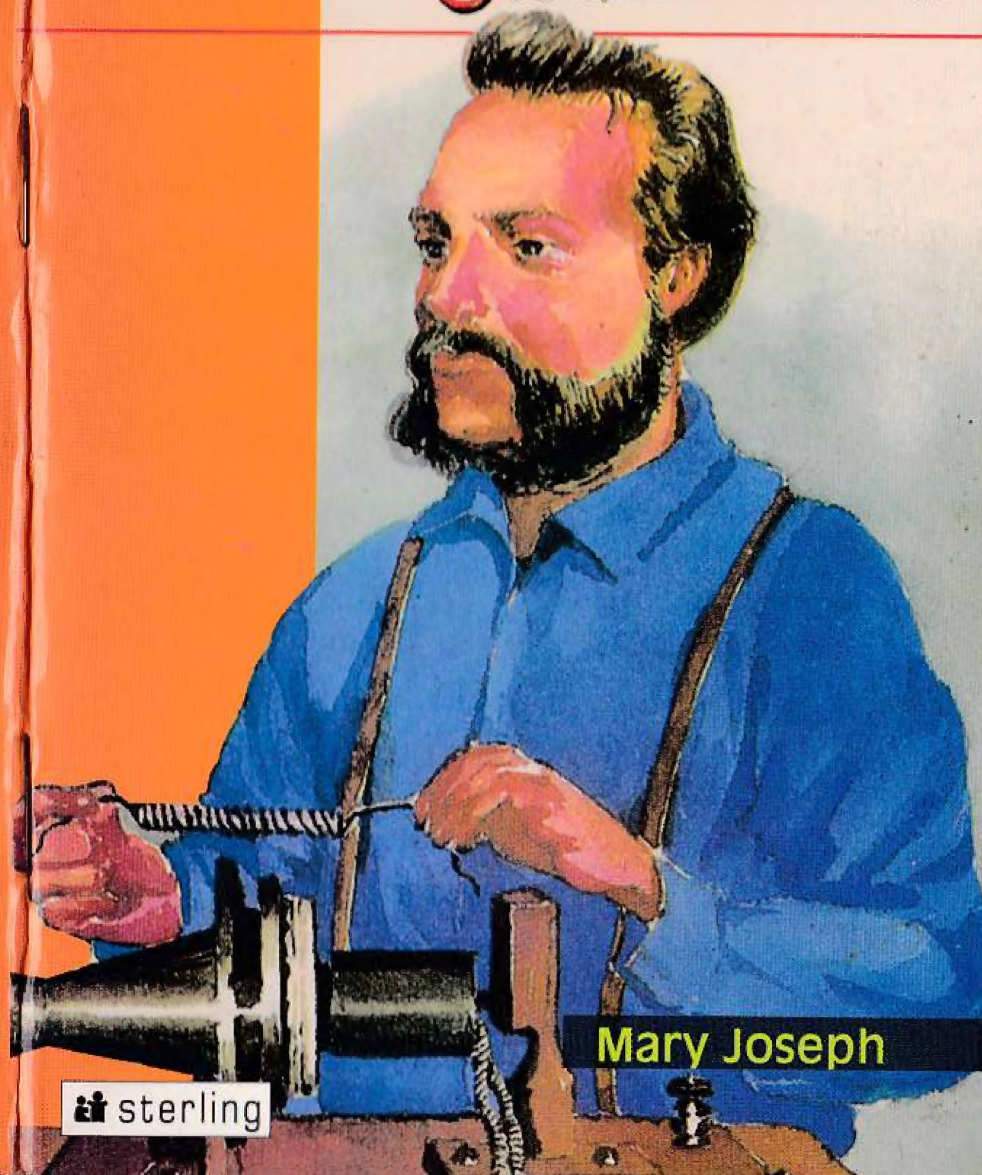


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Scientists of the World

Alexander Graham Bell



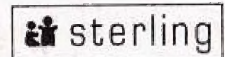
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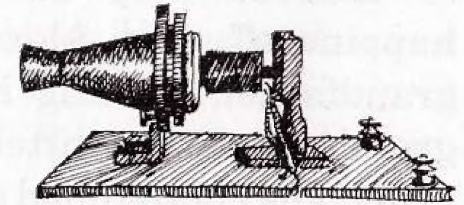
Scientists of the World

Alexander Graham Bell

Mary Joseph



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Let's learn to speak

Little Graham's face was a picture of concentration as he stood in front of the table, leaning against his father's knee. His father, Melville Bell, sat facing a lamp.

"Graham, watch the flame carefully, while I speak. *In Harcourt, Harford and Harleston, do hurricanes ever happen?* Did you see how the flame moved with the 'ha' sound?"

"Let me try," said little Graham, and then the naughty boy went, 'Ha, ha, ha, ha...', eager to blow out the flame. He loved to light the lamp, again and again.

"Heaven help us from so much happiness!" said Alexander Bell, his grandfather, tickling his five-year-old grandson, as he lifted him into his arms. They both rolled on the soft rug, a bundle of noise and laughter.

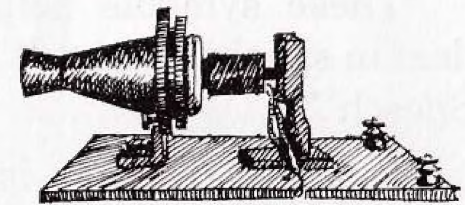
"Grandpa, tell Dad about last evening, and what I did," said Graham, who loved to hear events recounted, especially if he figured in them.

"Yes. Melville, last evening, at my drama-reading session, our young man had enough of it. He wanted to play with his grandpa. And so, before the session was over, this naughty boy rang the bell. But I caught him by the ear and continued: 'Friends, Romans and countrymen, lend me your ears.'"

At this point Graham burst into laughter. He thought it was rather clever and amusing of his grandfather to quote a line with ear in it, while he boxed his ear.

Named after his grandfather, Alexander adopted his second name, Graham, from a friend of the family. To his family and close friends, he was always Graham.

Graham came from a family that talked about speech and sound all the time. They listened to speech, they taught speech and they researched speech. His grandfather, Alexander, specialised in speech and taught elocution. He had also acted in plays for several years. Now he conducted drama-reading classes. Graham's father, Melville, also made speech his career. In fact, when Graham was born on March 3, 1847, his father was well established in Edinburgh, teaching speech, and writing and lecturing on elocution.



Can you hear me, Mum?

Graham loved to watch his father do research on the human voice. He loved to watch him draw the tongue, the teeth, the throat and the vocal chords. These are the parts of the body involved in producing sounds.

“What are you doing, Dad?” asked Graham, who stood next to his father, watching observantly.

“I’m drawing symbols which show the position of the vocal chords when we speak.”

“What are you doing that for? I like the flame game better,” said Graham.

"These symbols help to guide the deaf in speaking, son. It's called 'Visible Speech'."

"But this drawing is not like what Mum does."

"You're right, Graham. She's an artist and her 'landscapes' are beautiful, aren't they?"

"Yes, but I like it most when she plays the piano. Dad, I love music. I too want to play like her."

Often, Graham would watch his mother's delicate fingers float over the piano keys. When she played, she seemed to be in a different world. Music filled her soul. At times, she would stop and cuddle her little son, who stood close, looking up so adoringly at her. She would let him get the feel of the piano, guiding his fingers over the right keys.

"I can play too!" Graham would shout, excitedly, when he heard simple



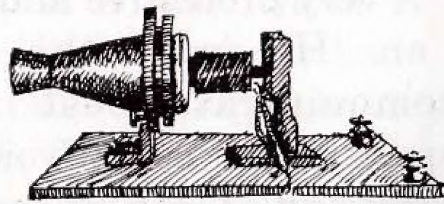
music float out, at a touch from his fingers. For, the little Graham had a keen ear and could distinguish very delicate sounds. He learnt to play easily. He did not have to just wish that he could play like his mother. The talent was inherent in him. His mother had passed it onto him. In fact, mother and son often entertained visitors with their music.

“Mum, shall I become a concert pianist, when I am older?” Graham asked his mother, at the end of one such performance. And his mother smiled. Always, she would only smile. In their house of speech and sound, she was the only quiet one.

It was only when Graham was a little older that he understood why his mother only smiled — why she was so quiet. Elisa Bell was almost deaf. And a deaf person automatically becomes mute, or silent. When he realised his mother’s problem, the young Graham

felt very protective and tender towards her. He was the one able to communicate best with her. By speaking in a low voice, close to her forehead, Graham could make his mother hear without her ear-tube.

Like his father and grandfather, Graham had a very expressive voice. He showed a real aptitude for his father’s work. This was due, partly to inherent talent and, partly because of the close companionship between Melville Bell and his little son. Mr. Bell would take time out of his work to coach Graham for elocution contests. His grandfather was always part of this too. Together, they always made Graham a winner.



There's so much happening!

The Royal High School at Edinburgh in England, where Graham studied, made life interesting for its students. There were many extra-curricular activities for them. Graham was an average student here. But the elocution, drama and music classes interested him greatly. He also enjoyed the school trips to the many mills and workshops nearby.

These visits got Graham interested in mechanics, and he obtained a great deal of knowledge about how things worked.

On one such visit to a mill, all the boys were given some stalks of wheat. Graham took some of the wheat home. Using a nail brush, he made a mechanical grain-husker which removed the husk, the outer covering of the wheat grain. When he showed it to the miller, he was so taken up with it, that he installed a machine which worked on the brush principle. This made Graham feel really good. His success encouraged his inventive nature, and he searched his mind for new ideas.

Meanwhile, Melville Bell continued his research on 'Visible Speech'. This kind of speech was mainly designed for phoneticians — people who teach a language. But it also helped deaf people pronounce words. It showed them, through symbols, how to form sounds which they had never heard.

"I have a challenge for you, boys," Mr. Bell said to his sons, one evening, at the dinner table.



"We're game, Dad," shouted his sons, all together. "What is it?"

"You have to make a machine that speaks," said Mr. Bell. "Are you still interested?"

"Of course we are," they said, wavering a bit.

A week went by with the Bell boys involved in nothing but the speaking machine. They thought, they planned, they drew; they made and re-made, till they finally succeeded.

Graham and his brothers set up the machine on a table and put up a curtain in front of it. At the far end of the room sat their audience — Melville and Elisa Bell, Graham's grandfather and a few family friends.

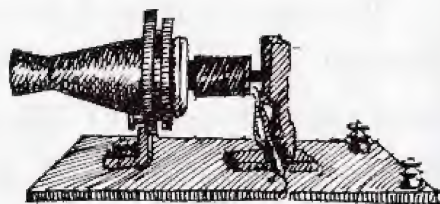
"You are here today," said Graham, "to see the latest invention of the 19th century."



“Never before has a machine been invented which speaks just like you and me,” said his elder brother.

And then at the ring of a bell by Graham, the curtains parted. On the table stood the machine. It had a throat, a nose, a mouth, a tongue which could move, and bellow lungs, all made of a flexible kind of glue. ‘Would it speak?’ the audience wondered. It did. It produced human-like sounds.

“Hurray for our young inventors!” said Graham’s grandfather. “And hurray for my son, Melville, who encourages such work!”



Through good times and bad

Graham was fifteen when he enrolled as a student at Weston House, a boys' school, near Edinburgh. He earned while he learned. In exchange for being taught other subjects, Graham himself taught speech and music at the school. Later, he studied at the University of Edinburgh for a year.

By the time Graham was seventeen, his father had completed his 'Visible Speech' system. The three Bell sons gave demonstrations, pronouncing correctly, sounds and foreign dialect words, unknown to them.

Later, the famous English playwright, George Bernard Shaw, who was a family friend, immortalised 'Visible Speech' in his play *Pygmalion*. Perhaps you have watched the film version of this play, *My Fair Lady*, where Professor Higgins uses 'Visible Speech' to change Eliza's incorrect accent.

In 1865, the Bell family moved to London. Once there, tragedy struck the family. Graham's younger brother died of tuberculosis. The disease had affected his lungs. To forget about this sad event, Graham got more deeply involved in his studies. He now studied at the University of London, where he also taught a class of deaf children.

One day, Graham met his teacher in the library.

"Graham, have you had a chance to read this book?" he asked.

"What's it on, sir?"



"It's on acoustics (the science of sound) and is written by the German physicist, Hermann von Helmholtz."

Graham borrowed that book. It described experiments which used electricity to make metal tuning-forks produce vowel sounds. It was this book that gave Graham the idea of telegraphing speech. He also discussed musical telegraphy with Sir Charles Wheatstone, who had improved telegraphy.

A few years passed with Graham deeply involved in his work. He was now a young man of twenty-three, but he was always sickly. He too had been affected by tuberculosis, which had killed both his brothers.

"Mr. Bell, perhaps you should move away from London?" said the doctor, after examining Graham one day. "The dampness here will only make his illness worse."

Mr. Bell agreed.

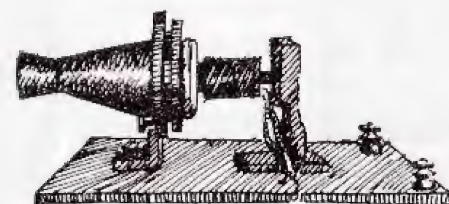
"Elisa, the last time I visited Canada on my lecture trip, I realised that the weather there, though cold, is dry. Why don't we settle down there?" he asked Elisa, after handing her hearing tube.

That night, they managed to convince Graham to move to Brantford, Ontario, which is in Canada.

For the Bell family, life in Canada was a full one. Mr. Bell, particularly, had too many lectures — more than he could cope with. One day as he sat reading his mail, he asked his son, "Graham, would you like to deliver a lecture for me? It's at 'Sarah Fuller's School for the Deaf' at Boston in the United States. I could write and ask the lady if you could replace me."

"That'll give me a break, father. I'd love to go."

Graham's lecture and demonstration were so successful that he decided to settle in Boston.



I care

Graham Bell was a very good teacher. This was not only because he knew his subject well, but also because he cared. He cared for the deaf whom he taught. Right from the time he got to know that his mother was deaf, he felt a natural sympathy towards people with this handicap. But he did not stop at feeling sorry. He always did something.

In 1872, Bell opened a school for the deaf in Boston. He was a very busy man. But however busy, he always made time to see parents with deaf children. He spent long hours with



them, giving them confidence, telling them that there was hope still.

Little George Sanders was in Bell's school, and this little boy adored his teacher. He wanted to be near him, always. At that time, Bell had just moved to Boston and had no proper place to live in. Seeing how much his son adored Bell, Mr. Sanders offered him a room in his house. Bell was extremely happy about the arrangement. His room was so large that he could use part of it to experiment in. And in this large house, young Georgie followed his teacher around. He watched his lips to try and understand what he was saying; he watched his every movement.

Also among Bell's students was a beautiful young woman named Mabel Hubbard. An attack of scarlet fever, during childhood, had left her deaf. Bell grew to love Mabel, and wanted to marry her. But at that time, he did not

have enough money to support her. He could only hope. He wished that one day he could invent something that would make him rich.

In the middle of the 19th century, a great deal was going on in the fields of science and technology in Boston. It is here that the famous University of Harvard is situated. It drew many scientists, inventors and artisans. Bell was very much part of it. He attended public lectures and read all the books he could get, on physics, acoustics and electricity.

Bell's familiarity with speech and sound-waves led him to experiment with the 'musical telegraph'. He used his talents in music to develop it. One day, while experimenting in his room at the Sanders' house, he had a couple of visitors.

"Hello, Mr. Hubbard! How nice to see you. Hello, Mabel!"

"Still at it, Graham?" asked Mr. Hubbard. "Do you have some time to talk?"

"Of course, Mr. Hubbard, I always have time for you. But I have something to share with you. I have just discovered that when a thin iron disc is made to vibrate close to a permanent magnet, with a coil of wire wound around it, a weak current arises in the coil. I think this is how sound can be communicated."

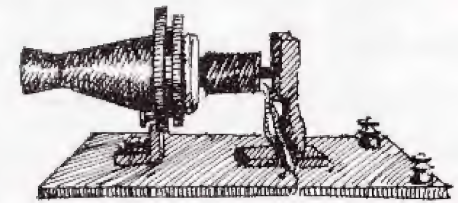
"Graham, I have full faith in you. Would I have helped you with money otherwise?" he asked, with a smile.

"The only problem, Mr. Hubbard, is that I lack the time to make all the necessary parts for my experiments. I'd rather spend more time with my students. Apart from that, I don't have the skill to make the instruments."

"You know, Graham, in the electrical shop down the road, you'll find a

mechanic named Mr. Watson. Perhaps he'll be able to help you out."

Soon Thomas Watson and Bell became very good friends. They worked late into the night on the musical telegraph, and were goaded on by the news that an electrician, named Elisha Gray, was working on a similar product. Bell wanted to transmit the human voice over telegraph wires. He was very keen on holding the patent for this. When you hold a patent for something, it means that you are recognised as the inventor of that thing.



One hot day in June

It was a hot day in June in 1875. Bell and Watson were tired after long hours of work, during which they had faced many disappointments. As they sat, giving it a last try, Bell jumped up at the twang of a spring, sent over a wire.

"That's it, Watson! We've got it!"

"What? What have we got?" asked the puzzled Watson.

"Now take the human ear. If the thin eardrum can move all the heavy bones in the ear, I'm sure a larger membrane ought to be able to move a metal disc. Speech can be transmitted in this way."

Bell and Watson got deeper and deeper into the research on the telephone. They worked hard, trying to transmit and receive sentences spoken by the human voice. On the afternoon of March 10, 1876, when Bell was in his room on top, and Watson was in the basement, with his ear glued to the receiver, Watson suddenly started. He was sure he had heard some words. Or had he?

He wondered if it had been just his imagination. And then he heard them a second time.

"Mr. Watson, come here. I want to see you."

Dropping the receiver, he flew up the stairs, his heart thumping with excitement. "You've done it, Mr. Bell! I heard you!"

And like children playing a game, they went from one room to another, reciting poems to each other.



That night, Graham wrote to his mother: "This is a great day for me. I feel that I have at last found the solution to a great problem and the day is coming when telegraph wires will be laid on to houses just like water or gas, and friends converse with each other without leaving home."

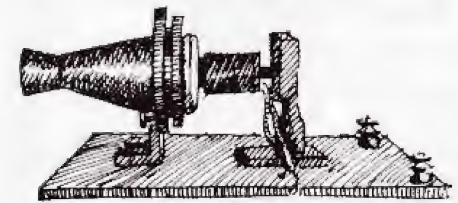
The next morning, Graham visited Mr. Hubbard.

"I think I've made it, sir."

"Then you must file your application for a patent."

"Not yet, sir. I want to check it out thoroughly, first."

But Mr. Hubbard had decided to file Graham's application, without letting him know. Nothing could have been better because Bell's 29th birthday gift was a patent for the telephone.

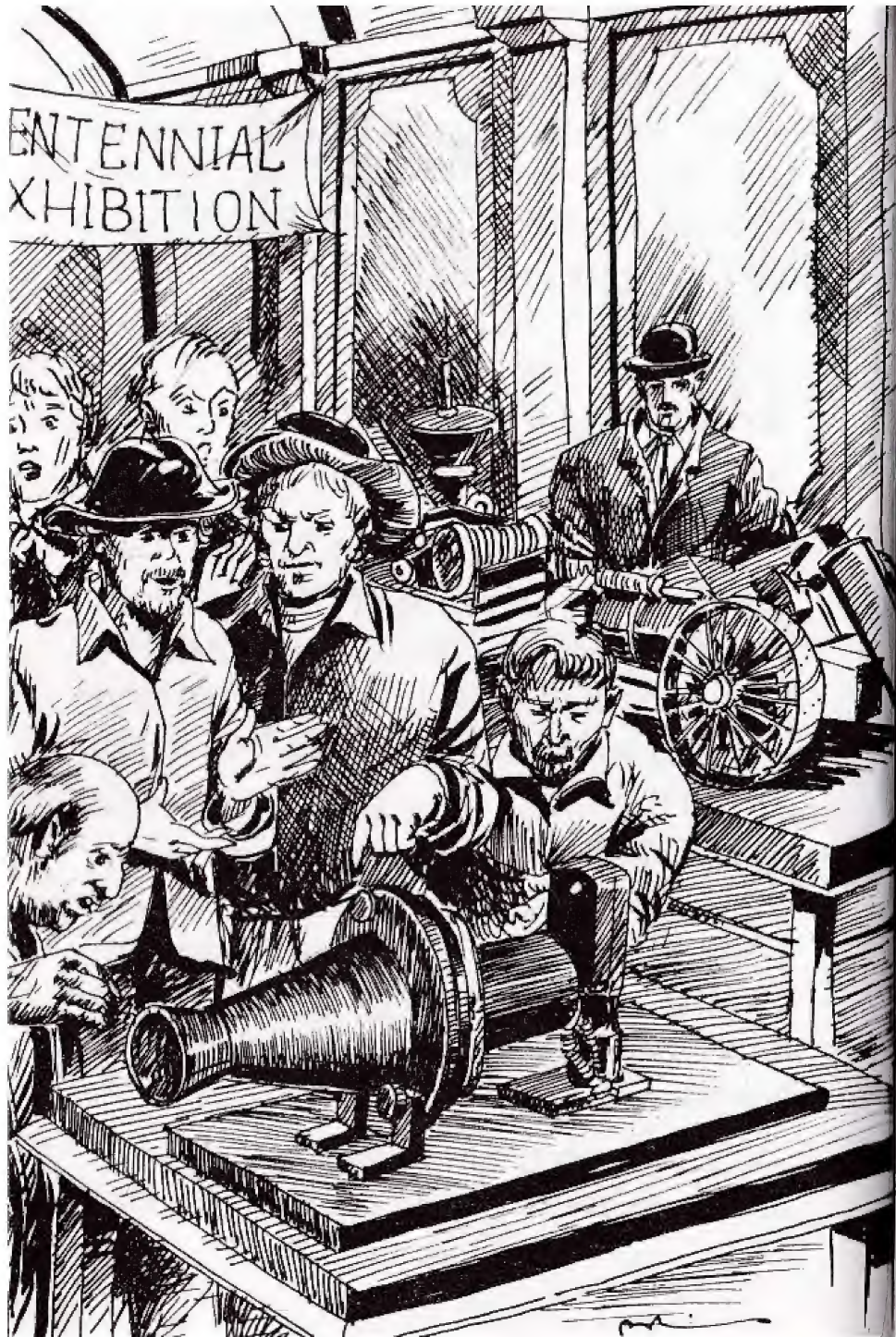


Does it ring a bell?

The Centennial Exhibition at Philadelphia presented Bell with a great opportunity. Now that the telephone had been invented, Bell had to make people accept it. He had to get some publicity.

"Mr. Bell, this is the most wonderful thing I've seen in America," said Sir William Thomson, a British scientist, looking at Bell's telephone. Bell had developed it further. It now had an iron-box receiver.

"Thank you, Sir Thomson. I plan to demonstrate it to Queen Victoria. But



before that, I'll do it for you." And he spoke into the mouthpiece, lines from Shakespeare's *Hamlet*: To be or not to be, that is the question.

"My God! It speaks!" cried the Brazilian emperor, Dom Pedro, who was ushered in at that moment.

A group of farmers who had come to look at new farming equipment on display, happened to pass by Bell's telephone. Hearing the distorted voice coming from the iron-box, they got scared, thinking that there was a devil inside.

As far as Bell was concerned, the Centennial Exhibition was a great success. Now he had enough money. He decided to form a company. The Bell Telephone Company came into existence on July 9, 1877. It included Watson, Gardiner Hubbard and Mr. Sanders, the father of little Georgie, who was deaf. By August, over

six hundred telephones were in operation. Graham Bell could now go to Mabel with a proposal.

“Dear Mabel, at last the time we’ve waited so long for, has come. I have enough money now.”

And so on July 11, 1877, Bell and Mabel got married. All eyes turned to the tall, imposing figure of Alexander Graham Bell, as he walked down the aisle with his beautiful bride. In his sympathy with the deaf, he had been generous enough to overlook Mabel’s handicap — her deafness. Her beauty and her friendly, outgoing nature, won his love.

All their friends and relatives waved them off at the seaport. They were off to England on their honeymoon. There, Bell planned to demonstrate his telephone to Queen Victoria.

Bell was a reserved man. It was Mabel who made friends for them. She



also took an active part in his work for the deaf. She was an accomplished speech-reader and often astonished new acquaintances with her ability to follow their conversation.

"Graham, I'm convinced that lip-reading is a better way of making the deaf communicate," she conveyed to Bell, one day.

"Yes, dear, because of you, I have started believing that too. Sign language, being a special language, cuts the deaf off from normal people."

"Apart from that lip-reading is easier."

But what could a year-and-a-half old child, like Helen Keller, struck deaf and blind after an attack of scarlet fever, do? She could not lip-read because she was blind. Helen's parents brought her to Dr. Bell.

"Dr. Bell, you have to find a way to help our little Helen."

"I personally can't help you, because I can only teach the deaf. But Dr. Howe, at the Perkins Institute for the Blind, had taught a child who, like Helen, was deaf and blind," Dr. Bell said.

"But how did he do it?"

"He taught the child to read and write by means of a finger alphabet, and communicate with people who can see and hear."

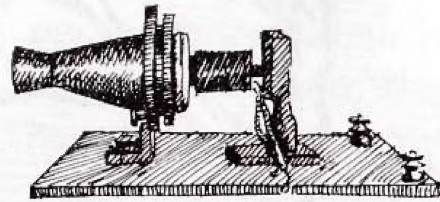
But that was not the end of Bell's interest in little Helen. His life was concerned with communication, and this was seen most in his concern for the deaf. And so, it was natural for him to want to help Helen. He followed her progress closely, visiting her, and sharing his thoughts with her parents and her teacher, Annie Sullivan. He encouraged them to attend meetings for the deaf, very often accompanying them, and often giving them the money needed.

"Annie, why don't you and Helen take a break at my summer house in Cape Breton?" Bell said to them one day. "I have already booked your tickets."

"That was one of the happiest times of my life," Helen said, later, in her book, *The Story of my Life*, which she dedicated to Dr. Bell. 'Few realise what a miracle language is, and fewer have as genuine a love of it as Dr. Bell,' she said.

Helen Keller is an outstanding example of a person who conquered physical handicaps. She learned to write and speak, she went to college, and she wrote many books. and most important of all, she cared for others. Like Alexander Bell who helped her, she always helped others.





Ring out the bells

Graham Bell and Mabel settled down in a fine country-home at Baddeck in Nova Scotia, Canada. There he devoted himself to invention.

The Bell Telephone Company made great progress, but Bell was not interested in running a business and withdrew from the board of directors. He then founded the Alexander Graham Bell Association for the deaf.

Apart from the telephone, Bell invented a few other things. He developed a telephonic probe which helped in surgery, by locating bullets



that had got lodged in a body. He also invented a 'vacuum jacket', a mechanical device, placed around the chest which helped in artificial respiration. Later, France awarded him the prestigious Volta Prize. Inspired by the Wright Brothers, he tried to build a flying machine. Bell also built the hydrofoil boat.

Have you seen the *National Geographic* magazine? Look for one in the book stores. This magazine was started by Mabel's father, Gardiner Hubbard. On his death, out of family loyalty, Bell took on the responsibility of the magazine. He made the magazine readable, by including eye-catching photographs and interesting articles. He employed a dynamic, new editor, G. Grosvenor, who later married his daughter, Elisa. The Grosvenor family is still active in the magazine.

While trying to invent the telephone, Graham Bell researched speech, music,



acoustics, mechanics and electricity. But to the last, he could never “understand how it is possible that someone can speak in Washington and someone else hear him at the foot of the Eiffel Tower.” Always humble, all he ever wanted was “to connect every man’s house, office or factory with a central station, so as to give him direct communication with his neighbours.”

America realised what Bell had done for the world. So, at the time of his death, all telephone services in the United States were stopped for a minute, in tribute to this great man. How easy it is now for us to pick up the telephone and talk to a friend, or attend to a problem. Almost every desk in an office has one on it. By giving us the telephone, Alexander Graham Bell has made our world a smaller place.